

REMARKS

Overview

In the Office Action under reply, the first on the merits, claims 1-19 were examined, claims 20-35 having been withdrawn as directed to non-elected subject matter. The claim rejections are as follows:

- (1) claims 1-19 are rejected under 35 U.S.C. §112, 1st paragraph, as based on a specification that is non-enabling;
- (2) claims 1-19 are rejected under 35 U.S.C. §112, 2nd paragraph, as indefinite;
- (3) claims 1-6, 10, 12-14, 18, and 19 are rejected under 35 U.S.C. §102(a) as anticipated by Jen et al., US 2004/0266954 ("Jen");
- (4) claims 1-6, 10, and 12-17 are rejected under 35 U.S.C. §103(a) as unpatentable over Jen; and
- (5) claims 1-19 are rejected under 35 U.S.C. §103(a) as unpatentable over Jen in view of Small et al., US 6,271,335 ("Small").

The rejections of the claims are overcome in part by the amendments made herein, and are otherwise traversed for at least the reasons set forth below.

Claim Amendments

By the amendments made herein, claim 1 has been amended to specify that the diene-containing and the dienophilic compounds are capable of undergoing a reversible Diels-Alder polymerization reaction. This amendment is made solely to clarify the claim language, and support for the clarified claim language can at least be found in the title of the application; no new matter has been added.

Rejection under 35 U.S.C. §112, 1st paragraph

Claims 1-19 are rejected under 35 U.S.C. §112, 1st paragraph, because the specification is said to be non-enabling. The Examiner states that the specification does not enable the skilled artisan because the terms "diene" and "dienophile" are not delineated or disclosed in the specification so that a skilled artisan would know what to employ.

The terms "diene" and "dienophile," in the context of Diels-Alder reactions, are art-recognized terms. Nearly any standard textbook in organic chemistry can be consulted to provide

descriptions of a variety of compounds that are included by these terms. The pertinent literature is extensive, spanning numerous decades of research in the chemical arts and citing hundreds (and perhaps thousands) of examples. Theoretical and computational chemistry provides methods for determining the behavior of compounds in Diels-Alder reactions without even requiring that the reactions be performed.

Furthermore, exemplary Diels-Alder reactions are provided or referenced in paragraphs [0029], [0089]-[0090], [0093], and [0097] of the specification.

According to MPEP § 2164.04, which cites *In re Wright*, 999 F.2d 1557, 1562, 27 USPQ2d 1510, 1513 (Fed. Cir. 1993), “[i]n order to make a rejection [over lack of enablement], the Examiner has the initial burden to establish a reasonable basis to question the enablement provided for the claimed invention.” The Examiner has not satisfied this requirement. Instead, the Examiner has simply stated that the terms “diene” and “dienophile” are not delineated or disclosed to such an extent that the skilled artisan would know what to employ. This rejection does not set forth the Examiner’s reason for believing the specification to be non-enabling - indeed, the specification itself states that “[w]hile certain Diels-Alder polymers may exhibit acceptable bonding and debonding performance, others may not” (see paragraph [0097]). However, the specification also states (in paragraph [0097]) that “[v]ariations of the present invention will be apparent to those of ordinary skill.”

Not only will variations of the invention be apparent to those of ordinary skill, but the experimentation that is required to verify such variations is not “undue,” as asserted by the Examiner. The MPEP (§2164.01(a)) mentions several factors that should be considered when determining whether the specification satisfies the enablement requirement and “whether any necessary experimentation is ‘undue.’” Among these factors are: (1) the breadth of the claims; (2) the state of the prior art; (3) the amount of direction provided by the inventor; and (4) the quantity of experimentation needed to make or use the invention based on the content of the disclosure. Based on these factors, the specification is clearly enabling for the pending claims. The claims are directed to compounds that are capable of undergoing a reversible Diels-Alder polymerization reaction. As mentioned previously, the state of the prior art is advanced in that a wide body of literature is available to provide examples of dienes and dienophiles. The specification provides sufficient guidance (see, for example, paragraphs [0086]-[0097]) for one of ordinary skill to be able to select appropriate compounds. Finally, based on such a selection, it

is a matter of routine experimentation for the skilled artisan to test the chosen compounds to determine whether they undergo a reversible Diels-Alder reaction as claimed. Of course, as stated in *In re Wands*, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988) (citing *In re Angstadt*, 573 F.2d 489, 502-04, 190 USPQ 214, 217-19 (CCPA 1976)), “[t]he test is not merely quantitative, since a considerable amount of experimentation is permissible, if it is merely routine, or if the specification in question provides a reasonable amount of guidance with respect to the direction in which the experimentation should proceed.” Because the specification provides such guidance, and because the Examiner has failed to raise specific reasons why one of ordinary skill would not be able to make or use the invention commensurate in scope with the claims, applicants respectfully request withdrawal of the rejection.

Rejection under 35 U.S.C. §112, 2nd paragraph

Claims 1-19 are rejected under 35 U.S.C. §112, 2nd paragraph, as indefinite. The Examiner states that the terms “diene” and “dienophile” render the claims vague since it cannot be determined what the actual metes and bounds of the claims may be. The Examiner further states that “the terms are deemed to embrace compounds that, by their very nature, such as in polymerized form, may not be suitable, as the claims recite, i.e., able to undergo a Diels-Alder reversible reaction.” This rejection is traversed.

As discussed *supra*, the terms “diene” and “dienophile” are art-recognized terms. One of ordinary skill would be able to determine, either by inspection or by routine experimentation, whether a mixture contains a diene and a dienophile as required by the pending claims.

Furthermore, the claims are internally consistent in that they require the diene and the dienophile to be compounds that are capable of undergoing a Diels-Alder reversible reaction. Thus, compounds that “may not be suitable,” as suggested by the Examiner, do not (by themselves) satisfy the limitations of the claims. One of ordinary skill in the art would understand that the diene and dienophile must be capable of reacting in a Diels Alder reaction; if a diene moiety and a dieneophilic moiety in a mixture of compounds are not capable of such a reaction, the mixture must include other diene and/or dienophilic moieties that *are* capable. The specification provides sufficient guidance for one of ordinary skill to determine the suitability of a particular mixture for the claimed processes and compositions.

The Examiner appears to be making the argument that the claims encompass non-working embodiments. However, the language of the claims very clearly states that compounds must be capable of undergoing a Diels-Alder reaction in order to satisfy the limitations of the claims. Accordingly, applicants respectfully request withdrawal of the rejection.

Rejection under 35 U.S.C. §102(a)

Claims 1-6, 10, 12-14, 18, and 19 are rejected under 35 U.S.C. §102(a) as anticipated by Jen. The Examiner states that Jen shows the production of a Diels-Alder reversible resin as claimed herein. A rejection under 35 U.S.C. §102(a) requires that the reference teach every limitation of the rejected claims. Jen fails to meet this requirement, however, and the rejection is therefore traversed.

First, claim 1 is directed to an encapsulant *fluid*. There is no indication that the materials of Jen are fluids. The materials described in Jen are exemplified by PSDACLD, which is prepared in the Example and is described in paragraph [0033]. In paragraph [0078] of Jen, PSDACLD is clearly described as a solid material (“The precipitate was collected and reprecipitation [*sic*] by adding dropwise its dichloromethane solution into methanol afforded polymer PSDACLD as blue-greenish solid”). At no point does Jen describe PSDACLD as a liquid formulation. In paragraph [0039], Jen describes numerous variations in temperature that are used to crosslink and un-crosslink PSDACLD. However, these reactions occur in the solid phase, and the polymer appears to remain as a film throughout the experiment. Indeed, Figure 3 of Jen shows differential scanning calorimetry plots (plots 2 and 3) and a thermogravimetric analysis plot (plot 1) from a crosslinking experiment using PSDACLD. From these plots, it appears that PSDACLD remains a solid throughout the experiment (plot 2 shows a glass transition at 100 °C, followed by a large endothermic peak resulting from the loss of furan). The disclosure of Jen is clearly directed to solid materials that may reversibly undergo Diels-Alder reactions in the solid state; accordingly, an encapsulant *fluid* is not disclosed in Jen.

Second, claim 1 requires an encapsulant fluid that comprises “a mixture of a diene-containing compound and a dienophilic compound.” Thus, the encapsulant fluid of the present claims has *two separate component compounds*. In contrast, Jen is directed toward compounds wherein the diene moiety and the dieneophile moiety are found within the *same* compound. Figure 1 in Jen shows an exemplary embodiment of the invention of Jen, namely, PSDACLD.

The polymer is shown as comprising a diene (i.e., a furan moiety) and a masked dienophile (i.e., a protected maleimide moiety), and these moieties are clearly part of the same compound. The necessity that the Diels-Alder reactive groups are located on the same molecule is corroborated by paragraph [0032] of Jen, which states that "...the crosslinkable polymers of the invention include three different functional moieties: (1) chromophore moieties... (2) dienophile moieties, such as capped maleimide, and (3) diene moieties, such as furan. The functional moieties are covalently attached to a polymer backbone..."

Clearly, the specification of Jen is directed to a *single, solid* material that contains Diels-Alder reactive groups. Accordingly, the disclosure of Jen does not anticipate the pending claims, which are: (a) directed to an encapsulant *fluid*; and (b) directed to a fluid comprising a *mixture* of two compounds (i.e., a diene-containing compound and a dienophilic compound). Accordingly, applicants respectfully request withdrawal of the rejection.

Rejection under 35 U.S.C. §103(a)

Claims 1-6, 10, and 12-17 are rejected under 35 U.S.C. §103(a) as unpatentable over Jen. The Examiner states that the use of a protected diene, as opposed to a protected dienophile, would be an obvious modification to a skilled artisan. This rejection is traversed.

The deficiencies of Jen with respect to the subject matter of the pending claims is discussed above. In particular, Jen fails to disclose an encapsulant *fluid*, and Jen furthermore fails to disclose a fluid comprising a *mixture* of a diene-containing compound and a dienophilic compound. For these reasons, as described above, the subject matter of the pending claims is not anticipated by the specification of Jen.

Furthermore, one of ordinary skill would not find the subject matter of the pending claims obvious in light of the teachings of Jen. According to the MPEP (§2142), three criteria must be met in order for there to be a *prima facie* case of obviousness:

First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

Regarding the first requirement, Jen does not provide any motivation to modify the materials disclosed therein in order to prepare an encapsulant *fluid* comprising a *mixture* of a diene-

containing compound and a dienophilic compound. Furthermore, the Examiner provides no motivation or explanation for why such a modification would be obvious. Regarding the third requirement for a *prima facie* case of obviousness, the failure of Jen to teach all of the claim limitations is described in detail above (i.e., with respect to the rejection under 35 U.S.C. §102(a)). Furthermore, Jen does not *suggest* preparation of a liquid formulation, nor does Jen suggest that the dienophilic moiety and diene moiety may be present in separate compounds. Indeed, Jen mentions that the material properties and processibility of the nonlinear optical polymers are quite important (see Background, paragraph [0004] of Jen). Thus, one of ordinary skill in the art would not be motivated to modify the materials disclosed in Jen in order to arrive at the materials of the present claims. For these reasons, regardless of the validity of the Examiner's claim that it would be obvious for one of ordinary skill in the art to use a protected diene as opposed to a protected dienophile, the Examiner has failed to present a *prima facie* case of obviousness of claim 1 as well as all of the claims dependent upon claim 1. Accordingly, applicants respectfully request withdrawal of the rejection.

Rejection under 35 U.S.C. §103(a)

Claims 1-19 are rejected under 35 U.S.C. §103(a) as unpatentable over Jen in view of Small. The Examiner states that Jen does not teach the protection of the diene component, and that Jen does not teach the use of bis(furan), tris(furan), or tetrakis(furan) moieties, as well as silicon containing dienes. The Examiner contends that Small provides these missing teachings.

The deficiencies of Jen are discussed above, with regard to the rejections under 35 U.S.C. §102(a) and §103(a). In summary, Jen fails to disclose an encapsulant *fluid*, and Jen furthermore fails to disclose a fluid comprising a *mixture* of a diene-containing compound and a dienophilic compound. Furthermore, there would be no motivation or reason for one of ordinary skill in the art to modify the materials of Jen as would be required to prepare the materials of the pending claims. For these reasons, as described above, the subject matter of the pending claims is not anticipated, nor is it rendered obvious, by the specification of Jen.

The Examiner has not provided evidence or argument why one of ordinary skill in the art would combine the teachings of Jen with those of Small. Pending claim 1 requires, in part, "a mixture of a diene-containing compound and a dienophilic compound, wherein *at least one of the diene-containing and the dienophilic compounds is protected* so that the compounds do not

substantially react with each other at room temperature,” (emphasis added). Small does not disclose such a mixture. Small discusses “a thermally reversible or thermally removable encapsulant, or polymer network, [that] is prepared by mixing at least one bis(maleimide) compound and at least one monomer compound containing multiple furan groups...” (col. 3, lines 30-33). Protecting groups are neither mentioned nor suggested in Small, and one of ordinary skill in the art would have no reason to believe that such groups are desirable based on the disclosure of Small.

Furthermore, with regard to the desirable properties of an encapsulant, Small states that it is desirable to have “reactants that are liquid at or near room temperature to provide easier encapsulation processing” (col. 2, lines 53-55). In light of this statement, and considering that Jen is directed to polymeric materials that are clearly not liquids at or near room temperature, one of ordinary skill in the art would be discouraged from combining the teachings of Small with those of Jen. One of ordinary skill would observe that the properties of the materials of Jen (i.e., Diels-Alder reactants in solid form) are undesirable in the materials of Small (i.e., liquid reactants), and vice versa; motivation to modify the materials of either reference based on the other would not be evident to one of ordinary skill in the art.


As discussed *supra*, the disclosure of Jen does not anticipate, nor does it render obvious the instant claims. At least because Small discourages the properties that are observed in the materials of Jen, one of ordinary skill would not be motivated to modify the materials of Jen based on the disclosure of Small. For at least these reasons, the combination of Jen and Small does not present a *prima facie* case of obviousness, and applicants respectfully request withdrawal of the rejection.

CONCLUSION

Applicants submit that the claims of the application are in condition for allowance. Applicants respectfully request withdrawal of the rejections, and prompt issuance of a notice of allowance. If the Examiner has any questions concerning this communication, or would like to discuss the application, the art, or other pertinent matters, a telephone call to the undersigned at (650) 251-7700 would be welcomed.

Respectfully submitted,

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